International Journal of Agricultural Science and Research (IJASR)
ISSN(P): 2250-0057; ISSN(E): 2321-0087
Vol. 7, Issue 1, Feb 2017, 183-186

EFFECT OF SUBSTRATE AND MOISTURE CONTENT ON MYCELIAL GROWTH OF *GANODERMA LUCIDUM* (LEYSS. EX. FR.) KARST

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ABSTRACT

Different substrates and moisture regimes were evaluated for mycelial growth optimization of Ganoderma lucidum. The fungal mycelium was grown on three substrates, viz. wheat straw, saw dust and wheat straw + saw dust (1:1) with four moisture levels, viz., 60±2 percent, 70±2 percent, 80±2 percent and 90±2 percent and radial growth was recorded at an interval of 3, 6, 9 and 12 days after inoculation. Maximum mycelial growth of G. lucidum was obtained in substrate, wheat straw + saw dust (24.78 mm) followed by saw dust (18.75 mm) and wheat straw (13.33 mm) at 70±2 percent moisture content. On the other hand, minimum mycelial growth was recorded at 90±2 percent moisture content of substrates in wheat straw + saw dust (13.73mm), followed by saw dust (9.30 mm) and wheat straw (7.13 mm) alone. Among the evaluated substrates having different moisture content, maximum mycelial growth was obtained at a moisture level of 70±2 percent followed by 80±2 percent, 60±2 percent and 90±2 percent irrespective of substrate used.

KEYWORDS: Ganoderma Lucidum, Moisture Content, Mycelial Growth & Substrate

Received: Dec 07, 2016; **Accepted:** Jan 12, 2017; **Published:** Jan 13, 2017; **Paper Id.:** IJASRFEB201725

Original Article

INTRODUCTION

Ganoderma lucidum is a basidiomycetous fungus that grows on decaying logs and tree stumps. In India, it is also called by different names like “Jarh Phorh” while in Haryana; it is popularly called as “Satpatra” and “Hirdo”. It is also known as Lingzhi in Chinese; Reishi, Mannentake, or Sachitake in Japanese; and Youngzi in Korean. *G. lucidum* is a mushroom of medicinal importance and all parts of this mushroom namely spore; mycelium and fruiting body are used in pharmaceuticals. The medicines are commonly prepared either as hot water extract, concentrate or in powdered form from this mushroom (Smith *et al.*, 2002). Out of more than 14,000 species of mushroom in the world, around 700 have been known for its medicinal properties. At present there are at least 270 species of mushrooms that are known to have various therapeutic properties. *G. lucidum* is probably the first medicinal mushroom to gain importance in India and the ethno-medicinal value of this mushroom was reported by Harsh *et al.*, (1993). Current world production of *G. lucidum* is more than 6000 tonnes, half of which comes from China; whereas, world trade in this mushroom is approx. 1.5 billion US$, and about Rs.120 crores/ annum in India (Geetha *et al.*, 2012). An attempt has been made in India to study the potential of medicinal mushrooms as an additional crop towards mushroom diversification. Singh *et al*., (2007) reported that wheat straw and saw dust and their combination supported maximum mycelium growth of *G. lucidum*. On the other hand, Berovic and Habijanic (2000) observed that, the moisture content of 70±2 percent was best for *G. lucidum* mycelial growth. Most of the mushrooms are being cultivated on agro-residues like sawdust/wood chips/wheat straw/paddy straw and in India, these are available in plenty and more than 600 million tonnes of crop residues is

generated annually. The present work was undertaken with an objective of finding the suitable substrate as well as proper moisture content for optimum mycelial growth of *G. lucidum*.

MATERIALS AND METHODS

The studies on different physiological parameters (substrate and moisture content) of the fungus *G. lucidum* were conducted under *in vitro* conditions. The mushroom (*G. lucidum*) was cultured on different substrate namely wheat straw, saw dust and wheat straw + saw dust (1:1) as a medium, to find out the best substrate for maximum mycelial growth. The experiment of different moisture regimes (60±2 percent, 70±2 percent, 80±2 percent and 90±2 percent) was carried out on different substrates, *viz.*, wheat straw; saw dust and wheat straw + saw dust (1:1) to evaluate the suitable moisture level for higher mycelial growth of *G. lucidum*. The different moisture levels of substrates were adjusted by Gravimetric method (FCQAO, 1994) and after adjusting the desired moisture content, substrates were sterilized in an autoclave at 22 psi pressure (121.6˚C) for 2 hrs. After cooling, five gram of each sterilized substrate was kept in nine cm diameter sterilized Petriplates with different treatments. The five mm mycelial bits of *G. lucidum* was placed at the centre of Petri plates containing different substrate having different moisture content under aseptic conditions and were incubated at 28±1˚C. The observations on radial mycelial growth were recorded at an interval of 72 hrs, after incubation upto 12 days.

RESULTS AND DISCUSSIONS

The data recorded on radial mycelial growth of the *G. lucidum* on different substrates and moisture regimes are presented in Table 1 (Figure 1) and moisture content of the substrate had profound effect on different mycelial growth. The perusal of data (Table 1) revealed that the significant variations in radial mycelial growth of *G. lucidum* were observed in substrates, *viz.*, wheat straw, saw dust and wheat straw + saw dust; by various moisture levels and at different days. In case of substrate wheat straw the maximum mycelial growth (13.33 mm) was observed at 70±2 percent moisture level followed by 80±2 percent (11.63mm) and 60±2 percent (9.15mm) and minimum (7.13mm) was observed at 90±2 percent moisture. Among the different days, highest growth (22.95mm) was observed at 12th days followed by 9th (12.95mm) and 6th (5.33mm) and no growth was reported at 3rd days. The interaction was found significant. On the other hand, when saw dust used as substrate, maximum mycelial growth (18.75mm) was observed at 70±2 percent moisture level followed by 80±2 percent (17.03mm) and 60±2 percent (12.90mm) and minimum (9.30mm) was observed at 90±2 percent moisture level. Among the different days, highest mycelial growth (31.88mm) was observed at 12th days and lowest growth (1.03mm) was at 3rd days. The interaction was found significant. When combination of wheat straw and saw dust in equal proportion was used as substrate, the maximum mycelial growth (24.78mm) was observed at 70±2 percent moisture level followed by 80±2 percent (21.93mm), 60±2 percent (19.55mm) and minimum (13.73mm) was observed at 90±2 percent moisture. Among the different days, highest growth (38.98mm) was observed at 12th days followed by 9th (27.98mm) and 6th (8.93) and lowest (4.10mm) was at 3rd days. The interaction was found significant.

Among the two substrates and their combination evaluated, maximum growth was in case of wheat straw + saw dust (24.78 mm) followed saw dust (18.75 mm) and wheat straw (13.33 mm) at 70±2 percent moisture level. On the other hand, minimum growth (13.73 mm) was recorded after 12 days of incubation, on substrate wheat straw + saw dust followed by saw dust (9.30 mm) and wheat straw (7.13 mm) at 90±2 percent moisture. Thus, best growth of *G. lucidum* was obtained when wheat straw + saw dust was used as substrate having 70±2 percent moisture content as compared to the other treatments. The results are in agreement with the studies of Berovic and Habijanic (2000) wherein, they reported

70±2 percent substrate moisture optimum for *G. lucidum* growth. On the other hand, 65±2 percent substrate moisture was found optimum for *G. lucidum* mycelial growth and its cultivation (Rai, 2003; Veena and Pandey, 2006). Singh *et al*., (2007) also reported that wheat straw and saw dust and their combination as suitable substrates for *G. lucidum* growth.

CONCLUSIONS

Among the evaluated substrates having different moisture content maximum mycelial growth was obtained at a moisture level of 70±2 percent in substrate wheat straw + saw dust (1:1), followed by 80±2 percent, 60±2 percent and 90±2 percent moisture in all the substrates, *viz.*, wheat straw + saw dust (1:1), saw dust and wheat straw alone.

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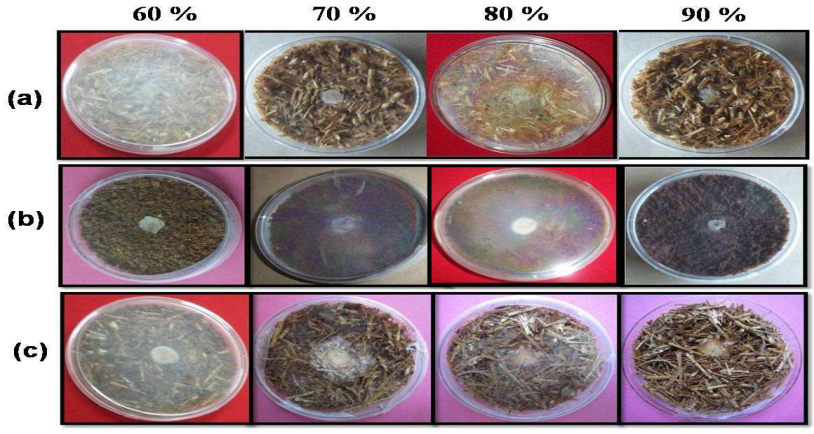
APPENDICES

Plate 1



(a) Wheat Straw (b) Saw Dust (c) Wheat Straw + Saw Dust (1:1)

Figure 1: Effect of Substrate's Moisture Content on Radial Growth of *G. Lucidum*

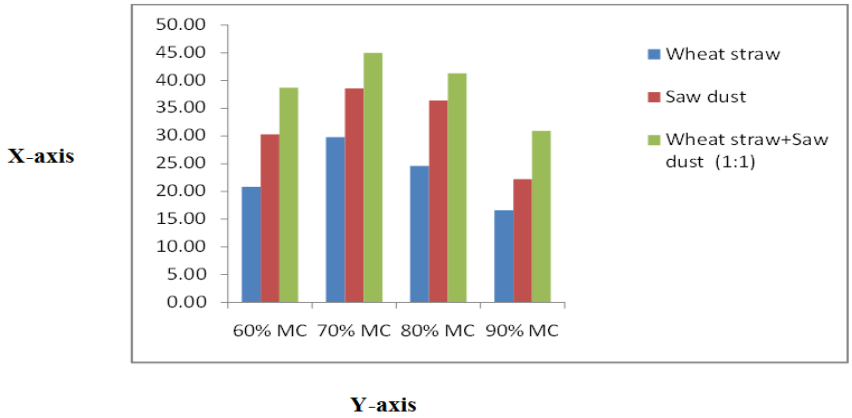


Figure 2: Effect of Different Substrates and Its Moisture Regimes on Radial Growth of *G. lucidum*. X= Radial Growth (mm) after 12 Days of Incubation, Y= Moisture Content (MC %)

Table 1: Effect of Different Substrates and Its Moisture Content on Radial Growth of *G. Lucidum*

SR. No.	Moisture Content (%)	Radial Growth* (mm) Days After Inoculation														
		Wheat Straw					Saw Dust					Wheat Straw + Saw Dust (1:1)				
		3	6	9	12	Mean	3	6	9	12	Mean	3	6	9	12	Mean
1.	60±2	0.00	4.20	11.60	20.80	**9.15**	0.00	5.20	16.10	30.30	**12.90**	3.10	6.50	29.90	38.70	**19.55**
2.	70±2	0.00	7.60	15.90	29.80	**13.33**	2.40	10.80	23.20	38.60	**18.75**	5.90	13.20	35.00	45.00	**24.78**
3.	80±2	0.00	6.70	15.20	24.60	**11.63**	1.70	8.60	21.40	36.40	**17.03**	4.70	10.40	31.30	41.30	**21.93**
4.	90±2	0.00	2.80	9.10	16.60	**7.13**	0.00	3.60	11.40	22.20	**9.30**	2.70	5.60	15.70	30.90	**13.73**
5.	Mean	**0.0**	**5.33**	**12.95**	**22.95**	-	**1.03**	**7.05**	**18.03**	**31.88**	-	**4.10**	**8.93**	**27.98**	**38.98**	-

Average of five replications

Table 2

CD At 5percent Level	Wheat Straw	Saw Dust	Wheat Straw + Saw Dust (1:1)
Treatments (T)	0.45	0.39	0.52
Radial growth (mm) (G)	0.45	0.39	0.52
T×G	**0.90**	**0.78**	**1.04**